Table 2-7 Regional Infiltration Basins Modeling Summary

Pond ID	Bloomington Basin	Location	Maximum Infiltration Area Available[1] (acres)	Potential Contributing Area (acres)[2]	% Impervious	Ground Elevation at Pond Location[3a]	Ground Elevation at Pond Location[3b]	Pipe Invert[4]	Pond Feasibility	Hydrologic Soils Group	Pond Depth (ft)	Pond Bottom Area[5] (Ac)	Infiltration Rate[6] (in/hr)	Maximum Expected Infiltration Volume[7] (acre-ft/year)	% Reduction in Runoff Volume	Maximum Expected TP Load Reduction[7,8] (lbs/year)	Maximum Expected TSS Reduction[7,8] (lbs/year)
1	Upper Nine Mile Creek	Hyland Ski Jump Area	4.8	144	27.6	812.5	813	810	Y	B/Undef	2	4.8	0.24	94	94	79	25214
10	Smith Pond	McAndrews Playlot	1.8	12	27.9	810.6	n/a	810.2/808.6	Y	Undef	2	1.8	0.24	8	99	7	2218
12	Smith Pond	Fenlason Park	2.3	78 - 147	52.7	821.6	822	820.8	Y	Undef	2	2.3	0.24	123	68	125	43566
13b/13c	Oxboro Lake	Dupont Playlot	0.8	10 - 435	35.8	811.3	812	813.5/809.7	Y	Undef	2	0.8	0.24	68	18	90	51031
6	Hampshire Pond	Quail Ridge Playlot	4.2	27 - 99	32.2	791.2-794.8	792-796	797.2/797	Y	A/B	2	4.2	0.24	76	96	64	20093
9	Smith Pond	Cooks Playlot	1.2	10	27.9	818	n/a	814.3/812.5	Y	Undef	2	1.2	0.24	7	98	6	1837
14	Oxboro Lake	John Deere Property	4.7	35 - 134	70.7	818.6	818	816.7	Y	Undef	2	4.7	0.24	185	86	171	55609
													TOTAL	**561**		**542**	**199,568**

1 - This maximum available area typically includes the entire park parcel, assuming the removal of features such as baseball diamonds, other sport courts, and playground equipment.

2 - Several ponds may have the option of diverting one or more storm sewers into the infiltration basin. Therefore, the range provided includes the smallest estimated watershed to the combined total potential contributing area. Additionally, diverting a portion of the flows through these systems may also be an option.

3a - Based on 5-foot contour information for Bloomington.

3b - Based on 2-foot contour information for Bloomington.

4 - Based on Storm Sewer GIS from the City of Bloomington.

5 - Assumes vertical sides.

6 - Infiltration Rate for Loam soils (Rawls, et al. 1998).

7 - Assumes maximum contributing area.

8 - This scenario assumes no pretreatment before the infiltration basin. It is recommended that runoff be pretreated prior to entering the infiltration basin to prevent clogging and enhance infiltration.

3.0 Results and Discussion

Table 3-1 shows the results of the loading assessment modeling, which were summarized for each of the 24 drainage basins to show the Simple Method loading and volume estimates for each time period (Without BMPs [Land Use Only]). Additionally, this table shows the loading and volume estimates after the implementation of current regulations (With BMPs [NURP Ponds Only]) for past development/redevelopment and parcels expected to develop/redevelop from the present to 2020 as well as the future loading with the implementation of infiltration and water quality BMPs (With BMPS [0.5” and 1.5” Infiltration w/ NURP Pretreatment]).

Evaluation of impacts of BMPs on Runoff, TP, and TSS loads was limited to structural practices such as ponds designed to NURP standards and infiltration basins sized to manage a select volume of runoff. There are a number of non-structural practices that the city of Bloomington has implemented to address surface water quality runoff. These practices include the implementation of a (biannual) street-sweeping routine, construction of sump manholes and requiring the use of phosphorus-free fertilizers since 2005. Street sweeping can reduce both TP and TSS loads and studies of high-efficiency street sweeping indicated that TSS reductions can range from 25 to 40 percent (Pitt, Bannerman, and Sutherland, 2004). Studies evaluating the impact of a phosphorus fertilizer ban suggest that phosphorus loads from pervious areas that would typically be fertilized would result in a 17 percent TP load reduction (Barten and Jahnke, 1997). The impact of these practices on TP and TSS loads has not been factored into the city of Bloomington loading assessment and as a result, the estimates of TP and TSS loads for 2007 and 2020 in this report are likely over-estimated.

In addition to the a fore mentioned BMPs, the Nine Mile Creek Watershed District and the city of Bloomington implemented a stream stabilization project on Nine Mile Creek between Old Shakopee Road and the approximate intersection of Queens Circle in the late-1980/early-1990’s. This stabilization project and associated annual maintenance performed by the city of Bloomington was initiated to strengthen the stream banks, restore areas of existing erosion and enhance habitat.

Table 3-1 Bloomington Nondegradation Loading Assessment Summary

Without BMPs (Land Use Only)

	WATERSHED TOTAL RUNOFF (acre-feet)			WATERSHED TP YIELD (LBS)			WATERSHED TSS YIELD (LBS)		
WATERSHED	**1988**	**2007**	**2020**	**1988**	**2007**	**2020**	**1988**	**2007**	**2020**
10th Ave.	73	72	72	58	58	58	10,445	10,375	10,375
11th Ave.	282	282	282	218	216	216	37,385	36,574	36,574
3rd Ave.	191	192	192	145	145	145	22,554	22,601	22,601
Airport South	899	973	1,018	594	629	647	133,815	140,895	146,593
494 East	68	84	86	43	50	52	10,021	11,352	11,660
Brook Side	249	247	247	174	173	173	27,673	27,100	27,100
Bush Lake	935	990	991	234	276	276	32,500	40,775	40,919
Colorado Pond	689	694	694	333	338	338	55,803	56,707	56,718
France Ave.	188	188	189	139	140	140	21,825	21,890	22,046
Hampshire Pond	985	1,320	1,333	686	917	936	151,437	224,611	231,599
Hopkins Road	555	558	562	362	366	371	68,772	70,046	69,610
Lower Nine Mile Creek	1,127	1,141	1,147	713	721	726	115,662	118,186	119,358
Marsh Lake	432	438	438	232	236	237	38,288	39,164	39,217
Minnesota River Direct	6,719	6,845	6,874	540	620	638	80,548	97,389	102,968
Overlook Lake	406	429	430	311	328	329	55,615	60,044	60,569
Oxboro Lake	2,408	2,411	2,436	1,684	1,673	1,689	389,452	381,513	386,462
Penn Lake	1,298	1,299	1,304	810	812	819	149,529	149,661	152,241
Riley Purgatory	888	946	947	534	585	585	91,535	103,945	104,045
Skriebakken	845	851	846	475	478	475	87,021	87,675	86,215
Smith Pond	1,653	1,668	1,669	1,216	1,215	1,216	240,600	237,360	237,756
South Glen	679	684	684	434	437	438	76,758	77,098	77,357
Upper Nine Mile Creek	3,406	3,489	3,529	1,093	1,141	1,165	208,196	218,759	224,367
West Marsh Lake	251	257	257	177	182	182	28,528	29,797	29,797
York Ave.	621	621	628	302	302	307	51,423	51,149	52,291
TOTAL	**25,848**	**26,678**	**26,855**	**11,508**	**12,036**	**12,159**	**2,185,388**	**2,314,667**	**2,348,439**

Table 3-1 Bloomington Nondegradation Loading Assessment Summary (Cont.)									
With BMPs (Existing and Past Regulations (NURP Ponds))									
	WATERSHED TOTAL RUNOFF (acre-feet)			WATERSHED TP YIELD (LBS)			WATERSHED TSS YIELD (LBS)		
WATERSHED	**1988**	**2007**	**2020**	**1988**	**2007**	**2020**	**1988**	**2007**	**2020**
10th Ave.	73	72	72	58	57	57	10,445	10,305	10,305
11th Ave.	282	282	282	218	215	215	37,385	36,343	36,340
3rd Ave.	191	192	192	145	145	145	22,554	22,573	22,573
Airport South	899	973	1,018	594	584	563	133,815	129,747	126,593
494 East	68	84	86	43	43	43	10,021	9,694	9,698
Brook Side	249	247	247	174	172	172	27,673	27,005	27,005
Bush Lake	935	990	991	234	235	235	32,500	32,833	32,821
Colorado Pond	689	694	694	333	332	332	55,803	55,981	55,958
France Ave.	188	188	189	139	139	139	21,825	21,762	21,777
Hampshire Pond	985	1,320	1,333	686	771	764	151,437	182,043	179,858
Hopkins Road	555	558	562	362	359	350	68,772	68,424	63,831
Lower Nine Mile Creek	1,127	1,141	1,147	713	707	706	115,662	115,224	114,551
Marsh Lake	432	438	438	232	231	231	38,288	38,070	38,053
Minnesota River Direct	6,719	6,845	6,874	540	558	556	80,548	85,432	84,602
Overlook Lake	406	429	430	311	314	312	55,615	56,764	56,199
Oxboro Lake	2,408	2,411	2,436	1,684	1,619	1,624	389,452	366,843	367,048
Penn Lake	1,298	1,299	1,304	810	798	790	149,529	146,746	145,945
Riley Purgatory	888	946	947	534	535	536	91,535	91,803	91,812
Skriebakken	845	851	846	475	471	462	87,021	86,173	82,637
Smith Pond	1,653	1,668	1,669	1,216	1,192	1,180	240,600	232,638	227,784
South Glen	679	684	684	434	428	427	76,758	75,404	75,143
Upper Nine Mile Creek	3,406	3,489	3,529	1,093	1,081	1,082	208,196	203,266	202,565
West Marsh Lake	251	257	257	177	178	178	28,528	29,027	29,027
York Ave.	621	621	628	302	299	301	51,423	50,673	50,780
TOTAL	**25,848**	**26,678**	**26,855**	**11,508**	**11,461**	**11,399**	**2,185,388**	**2,174,774**	**2,152,908**

Table 3-1	Bloomington Nondegradation Loading Assessment Summary (Cont.)								
With BMPs (0.5" Infiltration w/ NURP Pretreatment)									
	WATERSHED TOTAL RUNOFF (acre-feet)			WATERSHED TP YIELD (LBS)			WATERSHED TSS YIELD (LBS)		
WATERSHED	**1988**	**2007**	**2020**	**1988**	**2007**	**2020**	**1988**	**2007**	**2020**
10th Ave.	73	72	72	58	57	57	10,445	10,305	10,305
11th Ave.	282	282	282	218	215	215	37,385	36,343	36,340
3rd Ave.	191	192	192	145	145	145	22,554	22,573	22,573
Airport South	899	973	954	594	584	541	133,815	129,747	125,803
494 East	68	84	84	43	43	42	10,021	9,694	9,671
Brook Side	249	247	247	174	172	172	27,673	27,005	27,005
Bush Lake	935	990	990	234	235	235	32,500	32,833	32,807
Colorado Pond	689	694	694	333	332	332	55,803	55,981	55,955
France Ave.	188	188	188	139	139	139	21,825	21,762	21,765
Hampshire Pond	985	1,320	1,287	686	771	749	151,437	182,043	179,040
Hopkins Road	555	558	538	362	359	342	68,772	68,424	63,460
Lower Nine Mile Creek	1,127	1,141	1,137	713	707	703	115,662	115,224	114,386
Marsh Lake	432	438	438	232	231	231	38,288	38,070	38,047
Minnesota River Direct	6,719	6,845	6,830	540	558	544	80,548	85,432	84,030
Overlook Lake	406	429	425	311	314	311	55,615	56,764	56,102
Oxboro Lake	2,408	2,411	2,413	1,684	1,619	1,618	389,452	366,843	366,625
Penn Lake	1,298	1,299	1,283	810	798	781	149,529	146,746	145,643
Riley Purgatory	888	946	946	534	535	535	91,535	91,803	91,804
Skriebakken	845	851	833	475	471	458	87,021	86,173	82,451
Smith Pond	1,653	1,668	1,646	1,216	1,192	1,173	240,600	232,638	227,315
South Glen	679	684	681	434	428	426	76,758	75,404	75,097
Upper Nine Mile Creek	3,406	3,489	3,482	1,093	1,081	1,069	208,196	203,266	202,002
West Marsh Lake	251	257	257	177	178	178	28,528	29,027	29,027
York Ave.	621	621	622	302	299	299	51,423	50,673	50,688
TOTAL	**25,848**	**26,678**	**26,521**	**11,508**	**11,461**	**11,292**	**2,185,388**	**2,174,774**	**2,147,942**

Table 3-1 Bloomington Nondegradation Loading Assessment Summary (Cont.)									
With BMPs (1.5" Infiltration w/ NURP Pretreatment)									
	WATERSHED TOTAL RUNOFF (acre-feet)			WATERSHED TP YIELD (LBS)			WATERSHED TSS YIELD (LBS)		
WATERSHED	**1988**	**2007**	**2020**	**1988**	**2007**	**2020**	**1988**	**2007**	**2020**
10th Ave.	73	72	72	58	57	57	10,445	10,305	10,305
11th Ave.	282	282	282	218	215	215	37,385	36,343	36,340
3rd Ave.	191	192	192	145	145	145	22,554	22,573	22,573
Airport South	899	973	941	594	584	536	133,815	129,747	125,627
494 East	68	84	83	43	43	42	10,021	9,694	9,665
Brook Side	249	247	247	174	172	172	27,673	27,005	27,005
Bush Lake	935	990	990	234	235	235	32,500	32,833	32,804
Colorado Pond	689	694	694	333	332	332	55,803	55,981	55,955
France Ave.	188	188	188	139	139	139	21,825	21,762	21,762
Hampshire Pond	985	1,320	1,277	686	771	746	151,437	182,043	178,858
Hopkins Road	555	558	533	362	359	341	68,772	68,424	63,377
Lower Nine Mile Creek	1,127	1,141	1,135	713	707	702	115,662	115,224	114,349
Marsh Lake	432	438	438	232	231	230	38,288	38,070	38,046
Minnesota River Direct	6,719	6,845	6,820	540	558	541	80,548	85,432	83,903
Overlook Lake	406	429	424	311	314	310	55,615	56,764	56,080
Oxboro Lake	2,408	2,411	2,408	1,684	1,619	1,616	389,452	366,843	366,530
Penn Lake	1,298	1,299	1,279	810	798	779	149,529	146,746	145,576
Riley Purgatory	888	946	946	534	535	535	91,535	91,803	91,802
Skriebakken	845	851	830	475	471	457	87,021	86,173	82,410
Smith Pond	1,653	1,668	1,641	1,216	1,192	1,171	240,600	232,638	227,211
South Glen	679	684	681	434	428	426	76,758	75,404	75,086
Upper Nine Mile Creek	3,406	3,489	3,471	1,093	1,081	1,066	208,196	203,266	201,877
West Marsh Lake	251	257	257	177	178	178	28,528	29,027	29,027
York Ave.	621	621	621	302	299	298	51,423	50,673	50,667
TOTAL	**25,848**	**26,678**	**26,448**	**11,508**	**11,461**	**11,269**	**2,185,388**	**2,174,774**	**2,146,838**

3.1 Average Annual Runoff Volume

Table 3-1 and Figure 3-1 show that the total average annual flow volume from the city has increased slightly since 1989. The majority of the city of Bloomington was already developed by 1989 and would likely not have been developed incorporating NURP water quality ponds before this time. However, this analysis assumes that the current regulations (NURP ponds) have no impact on volume reduction. Runoff volumes increased by 3.2 percent from 1989 to 2007 and it is expected to increase by another 0.7 percent by 2020, assuming the implementation of NURP ponds only. Figure 3-2 shows the breakdown of runoff volume contributions by basin within the city and the total increase of about 1,000 acre-feet between 1989 and 2020.

Current regulations require the implementation of NURP pond but the City and watershed districts currently do not have runoff volume standards in place to address runoff volumes from new and redevelopment within the city. However, the Nine Mile Creek Watershed District does have draft infiltration rules requiring infiltration of the first inch of runoff from new and redevelopment sites. The scenario evaluating volume reduction through infiltration from the present to 2020 (see Table 3-1) indicates that the implementation standards requiring infiltration of the first 0.5 inches of runoff for new and redevelopment within the city can reduce the expected runoff volumes by roughly 33 percent when compared to the loads estimated by the installation of NURP ponds only. Though runoff volumes can be reduced, the City will need to take further action to meet the baseline runoff volumes.

One alternative is the construction of several regional infiltration basins. As previously mentioned, Figure 2-4 shows the potential locations of the regional infiltration basins within the city of Bloomington, and Table 2-7 summarizes the conceptual modeling results of each infiltration basin, providing an estimate of the impact of regional infiltration on loads from the city of Bloomington as well as an estimate of the amount of acres that would require treatment to meet the baseline conditions for runoff volumes.

Another alternative to infiltrate the additional 673 acre-feet of runoff not managed through implementation of infiltration standards would be to implement small-scale infiltration measures, such as rainwater gardens, associated with neighborhood street reconstruction projects. These types of BMPs would further reduce the pollutant loads. The first 0.5 inches of runoff from about 1,130 acres of low density residential areas, or 12 percent of the low density residential areas in Bloomington, would need to be diverted to rainwater gardens to reduce the 2020 annual volume by 673 acre-feet. A similar reduction could be realized if runoff from 690 acres of high density residential (71 percent) or 500 acres of commercial area (27 percent) were diverted to infiltration facilities.

Additional alternatives to address runoff volumes in the city of Bloomington are related to the abstraction of stormwater. There are many opportunities at a variety of scales that can allow for reductions in stormwater runoff volumes through evapotranspiration, storage and reuse, and storage with restricted or delayed discharge. Use of native vegetation in landscapes, which typically has more developed root systems than turf grass, can promote the infiltration of runoff into the ground and uptake by plants can increase evapotranspiration. Roof downspouts can be directed into stormwater planters that provide storage of stormwater, promote evapotranspiration through the planted vegetation, and provide treatment of water infiltrating through the soils while also providing an opportunity to improve aesthetics. Similarly, rain barrels and cisterns can allow for the collection of runoff from small areas, such as residential roofs, for reuse, such as irrigation, or for improved infiltration into the soil with the slow release of the stored water. There is also the opportunity for the collection and storage of runoff at the development site scale in large underground storage tanks that can also be reused for irrigation or other uses.

The proposed development at 8200 Norman Center Drive provides an example of the use of a variety of runoff abstraction and infiltration practices. The proposed development includes an 11-story office complex with an adjacent parking ramp. This development has been designed to achieve the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) standards. Part of the LEED certification process is related to site runoff and water management. This development has incorporated several rain gardens throughout the site along with including 97,000 gallons (approximately 0.35 acre-feet) of stormwater storage in a tank that will be constructed below the lowest floor of the parking ramp structure. This stored water will be used for site irrigation. Though this project will be constructed on a currently undeveloped site, it provides an example of variety of techniques that can be used to reduce the volume of runoff from both new development or redevelopment sites.

Finally, the Nine Mile Creek Watershed District has introduced the concept of volume banking. The District, in conjunction with participating municipalities, would provide a framework for those developments going above and beyond the District infiltration requirements to obtain volume credits. These credits would then be able to be sold to other permit applicants unable to achieve the infiltration requirements. The city of Bloomington could actively participate in this volume banking program and develop a process to obtain volume credits.

FIGURE 3-1
Bloomington Loading Assessment
Average Annual Flow Volume--City-Wide Basis

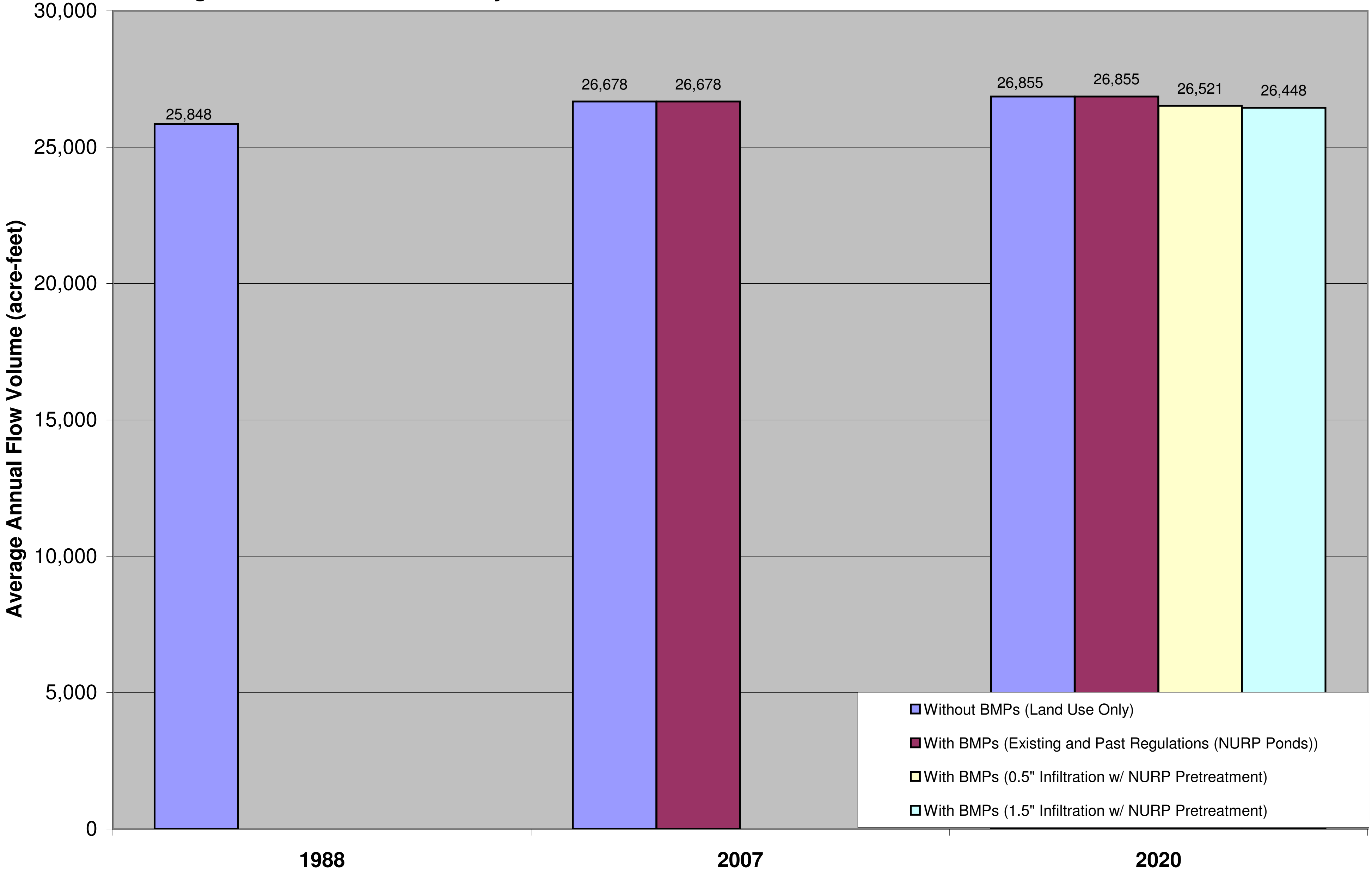
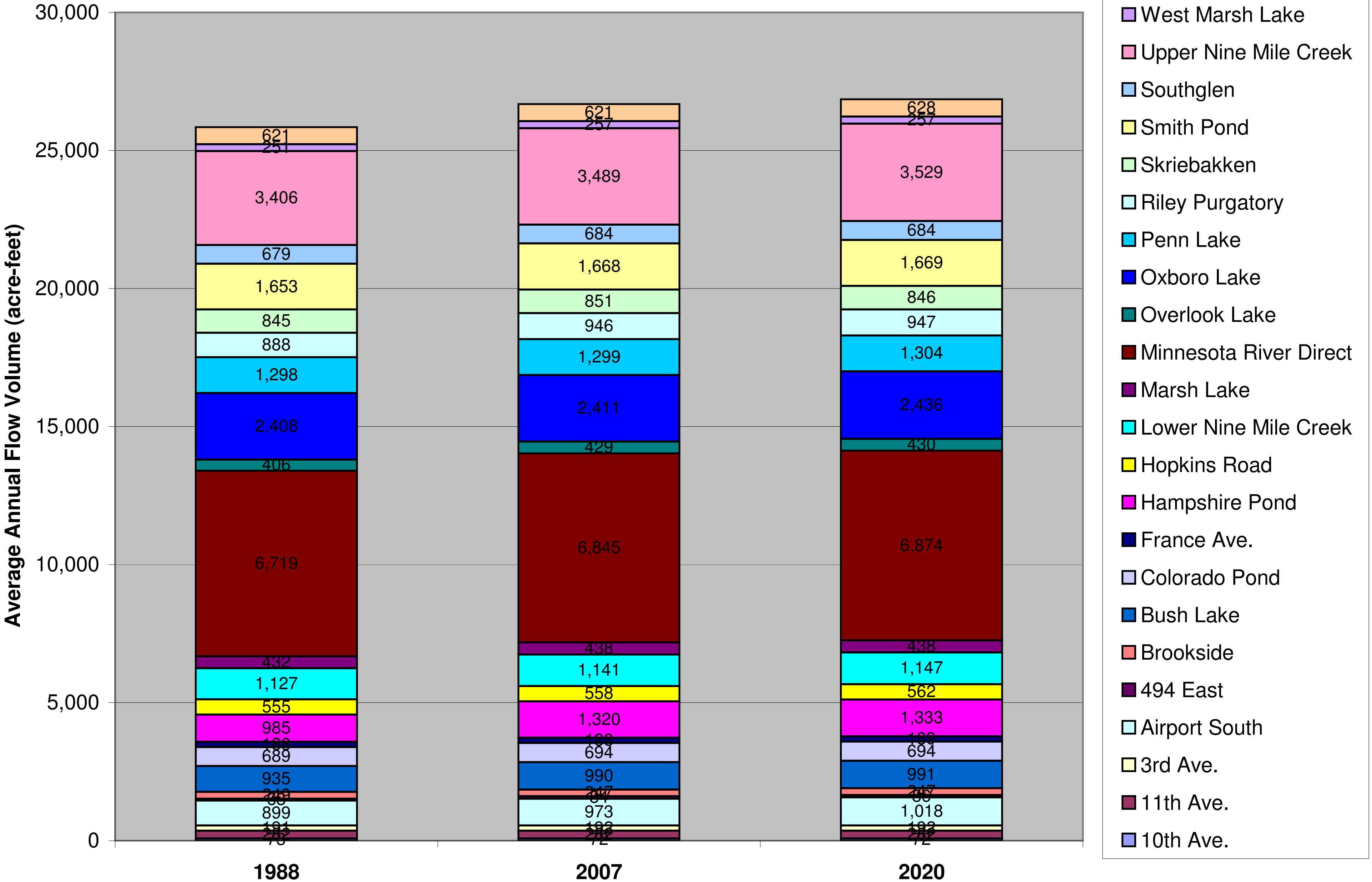


FIGURE 3-2
Bloomington Loading Assessment--Average Annual Flow Volume with BMP Implementation (Assuming Current Regulations)



P:\Mpls\23 MN\27\2327G75\WorkFiles\PollutantLoadingModel\FINAL_Nondeg_Load_Assess_Results_TP_TSS_LU_70207_sas.xls: StackedVolumeChart

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3.2 Total Phosphorus

Table 3-1 and Figure 3-3 show that the average annual TP loading from the city has increased since 1989 and would continue to increase slightly by 2020, without implementation of BMPs. As previously mentioned, the majority of the city of Bloomington was already developed by 1989 and would likely not have been developed incorporating NURP water quality ponds before this time. Table 3-1 shows that implementation of the NURP ponds within each of the city's watersheds has offset an increase in phosphorus load between 1989 and 2007. It is expected that the implementation of NURP ponds into the future will also help keep the total phosphorus loads in the future below baseline conditions, with 2020 TP loads expected to be about 2.1 percent lower than the estimated 1989 loads.

3.3 Total Suspended Solids

Table 3-1 and Figure 3-4 show that the average annual TSS loading from the city has increased since 1989 and would be higher by 2020, without implementation of BMPs. Table 3-1 and Figure 3-4 show that implementation of the NURP ponds within each of the city's watersheds has offset the increase in TSS load between 1989 and 2007 and resulted in an overall average annual TSS loading reduction in the city, compared to 1989 conditions.

Table 3-1 and Figure 3-4 also show that continued implementation of the NURP practices during new and redevelopment will continue to offset any estimated increases in watershed TSS loading between 2007 and 2020. Implementation of these practices will result in an overall TSS load decrease of 1.8 percent when compared to the 1989 TSS load.

FIGURE 3-3
Bloomington Loading Assessment
Total Phosphorus--City-Wide Basis

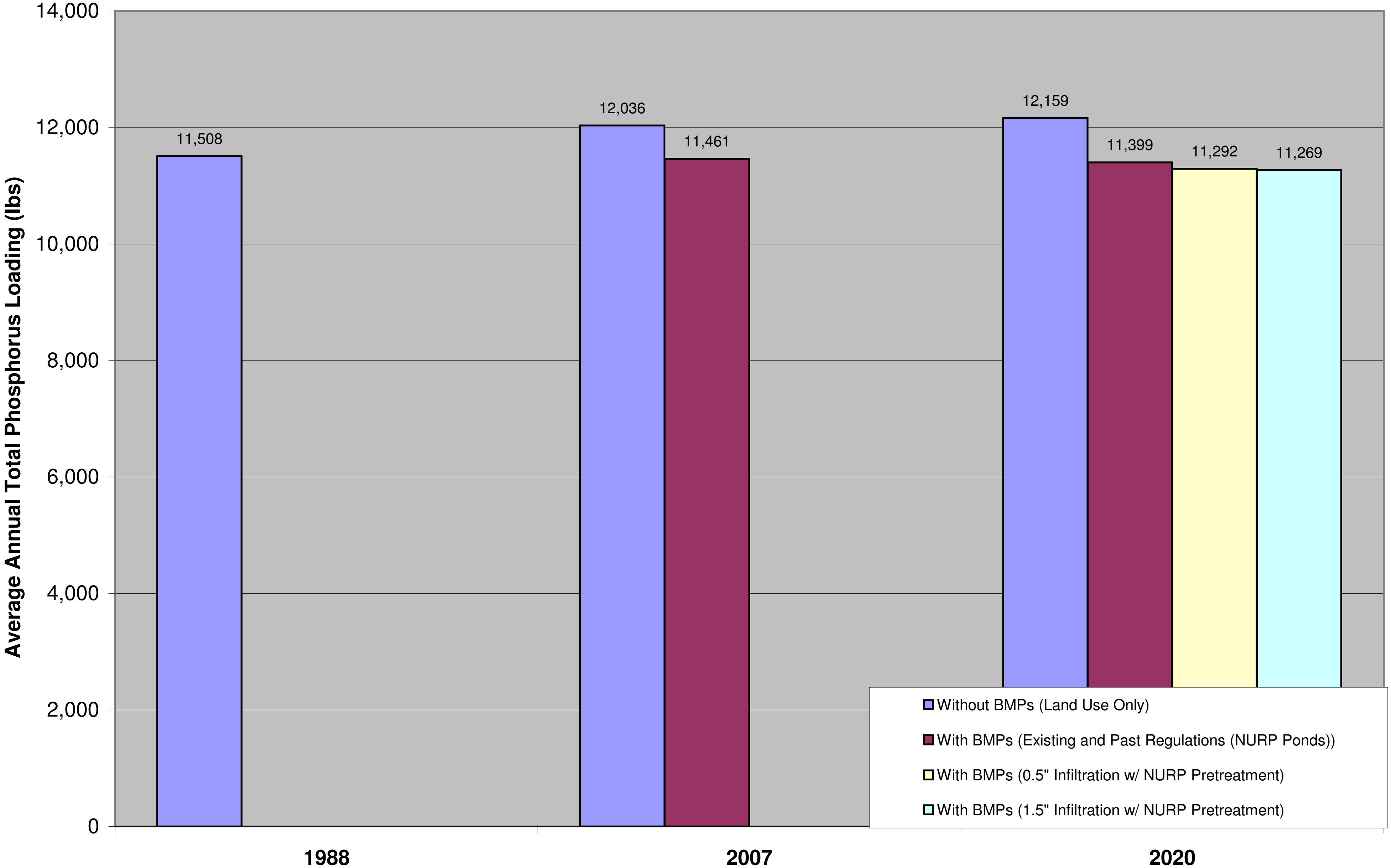

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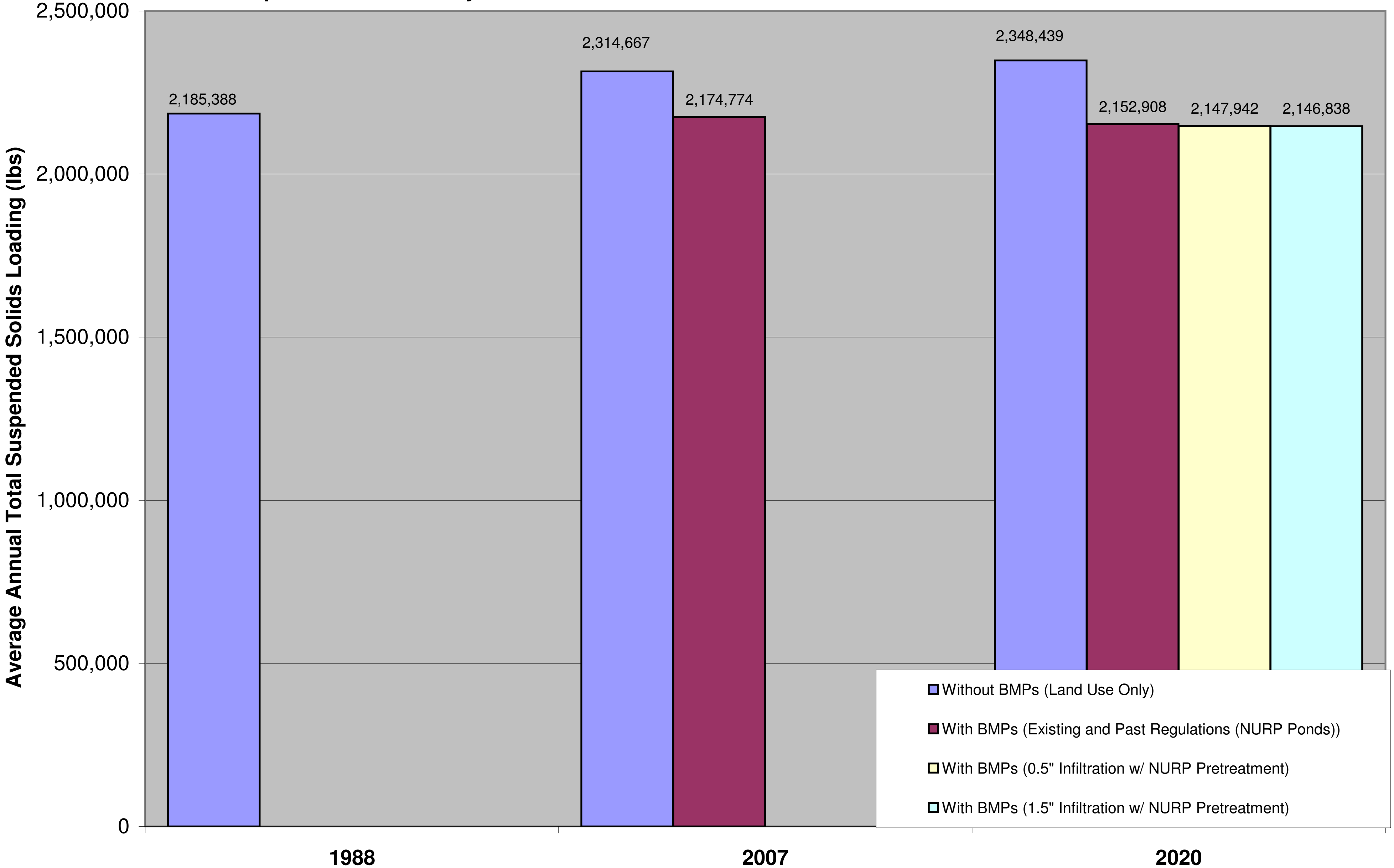
FIGURE 3-4
Bloomington Loading Assessment
Total Suspended Solids--City-Wide Basis



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3.4 Implications of Load Assessment Results

The results of the loading assessment indicate that, city-wide, the average annual flow volume loading estimates are only 3.9 percent higher in 2020 relative to the 1989 condition. The estimated increases in average annual flow volume constitute significant new or expanded discharges based on the Permit conditions. As discussed in Section 1.1.2 of this report, the Permit requirements state that a Nondegradation Report must be completed when Selected MS4s have significant new or expanded discharges, and upon approval, must incorporate its findings on BMPs that address nondegradation into their SWPPP. The BMPs should address changes in pollutant loadings as far as is reasonable and practical through future development. Additionally, the BMPs shall address, as far as is reasonable and practical, the negative impacts of increased stormwater discharge volumes that cause increased depth and duration of inundation of wetlands having the potential for a significant adverse impact to a designated use of the wetland, or changes in stream morphology that have the potential for a significant adverse impact to a designated use of the streams.

Since the city has experienced significant new or expanded discharges, the Permit requires that Bloomington prepare a Nondegradation Report that includes consideration of the Loading Assessment, which must include analysis of flow and may include removal of pollutants by BMPs already initiated.

4.0 Recommendations for Nondegradation Report

4.1 Water Quality Trend Analyses and Implications for Nondegradation Report

The results of the loading assessment indicate that, city-wide, the estimated TP loading is 0.4 percent lower in 2007 relative to the 1989 condition, after accounting for implementation of the applicable regulations. However, the average annual flow volume has increased by 3.2 percent during the same time period. As a result, the flow-weighted total phosphorus concentration of the runoff entering the receiving waters in the city would have decreased during the period between 1989 and 2007 and the receiving water quality would be expected to be maintained or improved during the same time period.

Appendix A of this report illustrates the results of the statistical trend analyses completed for lake water quality in each of the city lakes with a sufficient period of record of historical total phosphorus concentrations. For this report, the Mann-Kendall/Sen’s Slope Trend Test was used to determine water quality trends and their significance. To complete the trend test, the calculated summer average must be based on at least four measured values during the sampling season, and at least 5 years of data are required. A lakes’ water quality was considered to have significantly improved or declined if the Mann-Kendall/Sen’s Slope Trend Test is statistically significant at the 95 percent confidence interval.

Table 4-1 summarizes the results of trend analyses performed on a number of lakes within the city of Bloomington. Results show that statistically significant trends did not exist for Bush, Hyland, and Southeast Anderson Lakes. Trend analyses have not been completed for Normandale and Penn Lakes because of insufficient long-term total phosphorus data.

Table 4-1 Summary of Trend Analyses of Total Phosphorus in Lakes within Bloomington

Lake	Dates of Available TP Data	Statistically Significant Trend?
Normandale Lake	1990, 2002, 2005, 2006	No Trend Analysis Done (insufficient data)
Bush Lake	1975, 1982-1986, 1988, 1993, 1995, 2000-2001, 2004, 2006	No
Penn Lake	1973, 1979, 1980, 1990, 2001	No Trend Analysis Done (insufficient data)
Hyland Lake	1979-1981, 1988, 1990, 1992-1993, 1996, 1998, 2001-2002, 2004-2006	No
Southeast Anderson Lake	1988, 1991, 1996, 2000-2001	No

The results of the trends analyses are consistent with what would be expected for receiving water quality given the fact the flow-weighted TP concentration in the runoff entering the receiving waters, city-wide, would have decreased during the period between 1989 and 2007 and the receiving water quality would not be expected to degrade during the same time period. As a result, the trend analyses indicate that the NURP pond level of BMP treatment has likely ensured that the City can demonstrate that they have not degraded the receiving water quality for lakes, streams and wetlands due to new or expanded discharges of stormwater. Therefore, to satisfy the remaining Permit requirements, it is recommended that the Nondegradation Report focus special attention on addressing the concerns that the MPCA, public, and local water authorities might have about the increases in average annual runoff volume and its potential impacts on stream morphology and wetlands due to increased depth and duration of inundation.

4.2 Implications of Impaired Waters for Addressing Expanded Discharges in Nondegradation Report

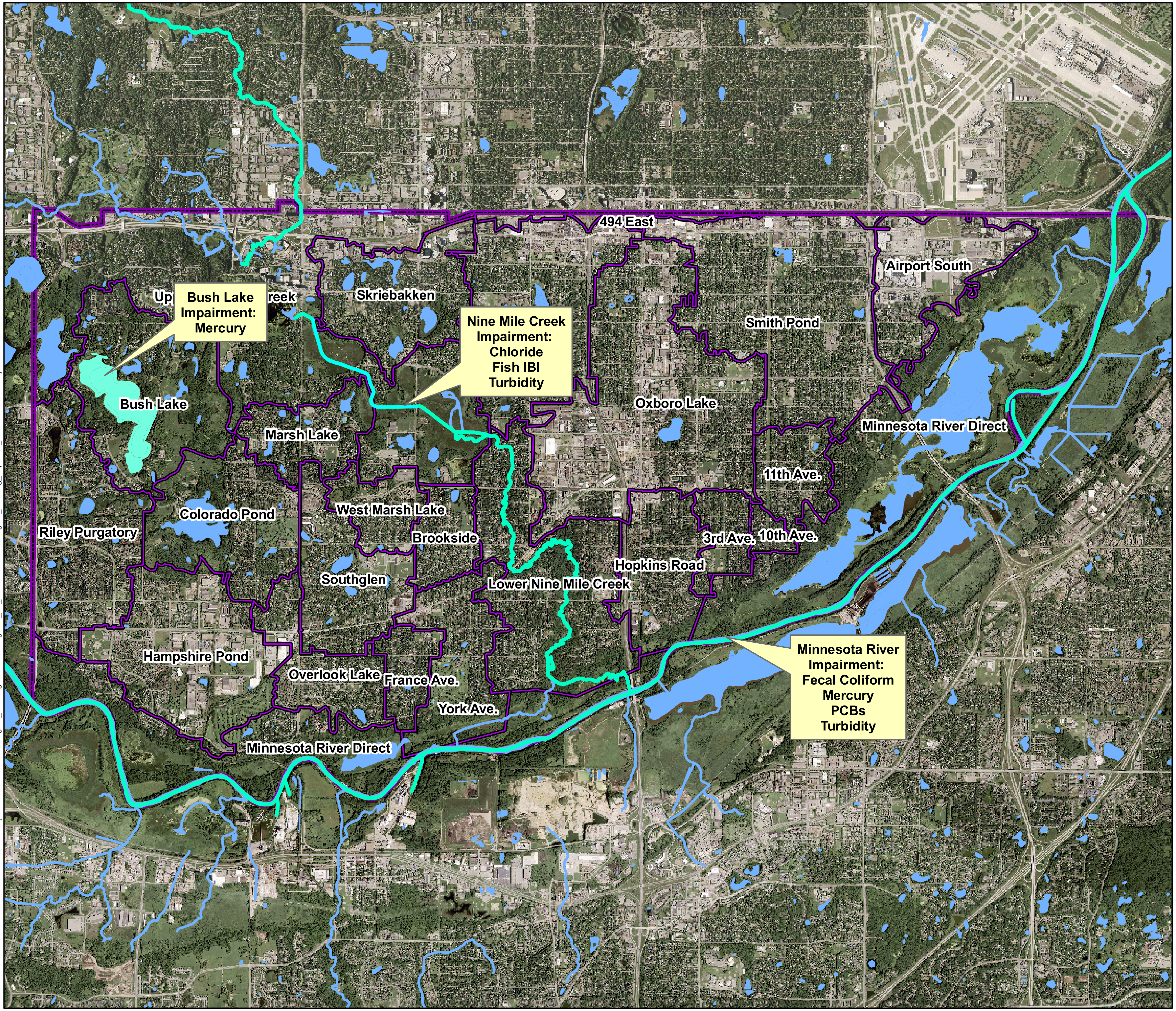
Figure 4-1 shows the receiving waters in the city that have been included on the 2006 MPCA 303(d) Impaired Water List because they do not meet the MPCA's water quality standards. There are only three water bodies in Bloomington listed and they include Bush Lake (listed for mercury), Nine Mile Creek (listed for chloride, fish IBI, and turbidity), and the Minnesota River (listed for fecal coliform, mercury, PCBs, and turbidity).

The U.S. Environmental Protection Agency (EPA) requires that the MPCA develop and submit Total Maximum Daily Load (TMDL) studies for each water body that they have on the impaired waters list. TMDL studies are used to determine what the maximum allowable pollutant loadings are for each water body without exceeding the water quality standards. The allowable pollutant loading is then allocated to each of the NPDES-permitted (including MS4s) and non-regulated sources of pollutants in the watershed.

Figure 4-1 shows that Nine Mile Creek is on the impaired waters list for chloride, turbidity, and biota-fish. The listing for Nine Mile Creek for turbidity may be the result of excess nutrient inputs. However, recent turbidity and fish biota data may lead to the Creek being delisted for these two impairments. Nine Mile Creek Watershed District is currently working with the MPCA to address this issue.

Although the Minnesota River is also listed on the impaired waters list, the city of Bloomington is a very small portion of the entire contributing watershed and load reductions within the City will likely have an insignificant impact on the overall quality of the Minnesota River. Additionally, it is important to note that the estimated current and future TP and TSS loads from the city of Bloomington are actually lower than the estimated loads from the City in 1988.

It is conceivable that the pollutant load allocations developed as part of future TMDL studies will dictate that the City will need to provide further loading reductions, beyond those currently projected in the nondegradation load assessment. As a result, it is recommended that as part of the development of the reasonable and practical BMPs for the Nondegradation Report, the City be cognizant of the potential implications of future TMDL allocations associated with the impaired waters that are receiving stormwater discharge.



Legend

- City Boundary
- Drainage Basins
- Streams
- Water Bodies
- Impaired Waters
- Impaired Streams

Feet

4,500 0 4,500

Figure 4-1
Impaired Waters

Bloomington Nondegradation Study
City of Bloomington, MN

4.3 Remaining Points to Address in Nondegradation Report

Since the City will be required to prepare a Nondegradation Report that includes consideration of the Loading Assessment, the following Permit requirements will also have implications for preparation of the Nondegradation Report:

- Local stormwater management plans and other pertinent factors may also be considered.
- BMPs implemented by other parties may be considered when those BMPs affect the stormwater from the area of the city.
- If the pollutant loadings cannot be reduced to levels consistently attained in 1989, the Nondegradation Report must describe reasonable and practical BMPs that the City plans to incorporate into a modified SWPPP. The City must consider alternatives, explain which alternatives have been studied but rejected and why, and propose alternatives that are reasonable and practical.
- The Nondegradation Report must give high priority to BMPs that address impacts of future growth, such as ordinances for new development. Where increases in pollutant loading have already occurred due to past development, the Nondegradation Report must consider retrofit and mitigation options (BMPs) that the city determines to be reasonable, practical and appropriate for the community.
- The City is responsible for developing any site-specific cost/benefit, social, and environmental information that they wish to bring to the Agency's attention.
- The City must incorporate the BMPs into a modified SWPPP and include an implementation schedule that addresses new development and retrofit BMPs it proposes to implement.

4.4 Recommendations for Using Load Assessment Modeling

As discussed in Section 2.3 of this report, the load assessment modeling consisted of a simplified approach that combined the results of the P8 modeling for the NURP pond level of BMP treatment with the Simple Method equations in a spreadsheet specifically developed to incorporate the land use/land cover information generated from GIS. Individual worksheets were developed in the spreadsheet for each of the three time periods of interest that determined the TSS, TP and volume contributions with the Simple Method equations. Another worksheet in the spreadsheet file contained the results of the P8 modeling that assessed the benefit that current and project future BMP implementation would have on the flow, TP and TSS loadings within the city limits for developments based on the design criteria examples that were indicative of the ordinances and design standards that were in place by the City, the watershed management organizations, the Wetland Conservation Act and the MPCA when development was supposed to occur. This same worksheet contains the remaining assumptions and inputs described in Section 2.3 of this report. Another worksheet was developed to combine all of the information generated from the Simple Method calculations in the worksheets for each time period with the results of the P8 modeling and calculate and summarize the volumes and TP and TSS loadings shown in Table 3-1.

Any changes that are necessary for the modeling should be made in the spreadsheet, following necessary changes to the GIS files or additional P8 models of BMP design criteria examples. The spreadsheet, GIS and P8 modeling files will be included as project deliverables for the City.

References

Athayede, D.N., R.P. Healy and R. Field. 1983. Results of the Nationwide Urban Runoff Program, Volume I – Final Report. U.S. EPA, Water Planning Division. NTIS PB84-185552.

Barr Engineering Company. 2004. Detailed Assessment of Phosphorus Sources to Minnesota Watersheds. Prepared for the Minnesota Pollution Control Agency.

Barten, J. and E. Jahnke. 1997. Suburban Lawn Runoff Water Quality in the Twin Cities Metropolitan Area, 1996 and 1997.

Barten, J. 1995. Quantity and Quality of Runoff From Four Golf Courses in the Twin Cities Metropolitan Area.

Burton, Jr., G.A. and R.E. Pitt. 2001. Stormwater Effects Handbook: A Toolbox for Watershed Managers, Scientists, and Engineers. ISBN 0873719247. Lewis Publishers. CRC Press, LLC.

DeByle, N.V and P.E. Packer. 1972. Plant Nutrient and Soil Losses in Overland Flow from Burned Forest Clearcuts. Proceedings of Symposium held at Fort Collins Colorado, June 19-22, 1972: Urbana Illinois, American Water Resources Association Proceedings Series, No. 14, P 296-307.

Harms, L.L., J.N. Dornbush, and J.R. Andersen, 1974. Physical and Chemical Quality of Agricultural Land Runoff. Journal of Water Pollution Control Federation 46(11):2460-2470.

Leopold *et al*. 1964. Quasi-Equilibrium States in Channel Morphology. American Journal of Science, Vol. 262, P.782-794

Metropolitan Council Environmental Services (MCES). 2005. 2004 Stream Monitoring and Assessment. Publication No. 32-05-071.

Metropolitan Council Environmental Services (MCES). 2004. Vermillion River Monitoring Station Information.

Minnesota Pollution Control Agency (MPCA). 1989. Protecting Water Quality in Urban Areas. Best Management Practices for Minnesota.

Minnesota Pollution Control Agency (MPCA). 2006. Draft Guidance Manual for Small Municipal Separate Storm Sewer Systems (MS4s). For General Permit Number MNR040000.

Minnesota Pollution Control Agency (MPCA). 2006. Minnesota Stormwater Manual.

Pitt, R., Bannerman, R., and R. Sutherland. 2004. The Role of Street Cleaning in Stormwater Management. Water World and Environmental Resources Conference 2004, Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah, July 27-August 1, 2004.

Pitt, R. 2003. The Design, Use, and Evaluation of Wet Detention Ponds for Stormwater Quality Management (Using WinDETPOND).

Rawls, *et al*. 1998. The Use of Soil Texture, Bulk Density, and the Slope of the Water Retention Curve to Predicted the Saturated Hydraulic Conductivity. Transactions of the ASAE. Vol. 41(4): 983-988

Reckhow, K.H., M.N. Beaulac, and J.T. Simpson. 1980. Modeling Phosphorus Loading and Lake Response Under Uncertainty: A Manual and Compilation of Export Coefficients. EPA 440/5-80-011.

Rosgen, D.L. 1994. A classification of natural rivers: Catena, v. 22, p. 169–199.

Schueler, T.R. 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Metropolitan Washington Council of Governments.

Sonzogni *et al*. 1980. Pollution from Land Runoff. Environmental Science and Technology.

USDA, 1972. Sediment sources, yields, and delivery ratios. National Engineering Handbook, Section 3 Sedimentation.

USGS. 1992. National Land Cover Dataset (NLCD). Digital Data.

U.S. Environmental Protection Agency (EPA). 1997. Compendium of Tools for Watershed Assessment and TMDL Development. EPA841-B-97-006.

Walker, W.W., Jr. 1987. Design Calculations for Wet Detention Ponds. Prepared for St. Paul Water Utility. St. Paul, MN.

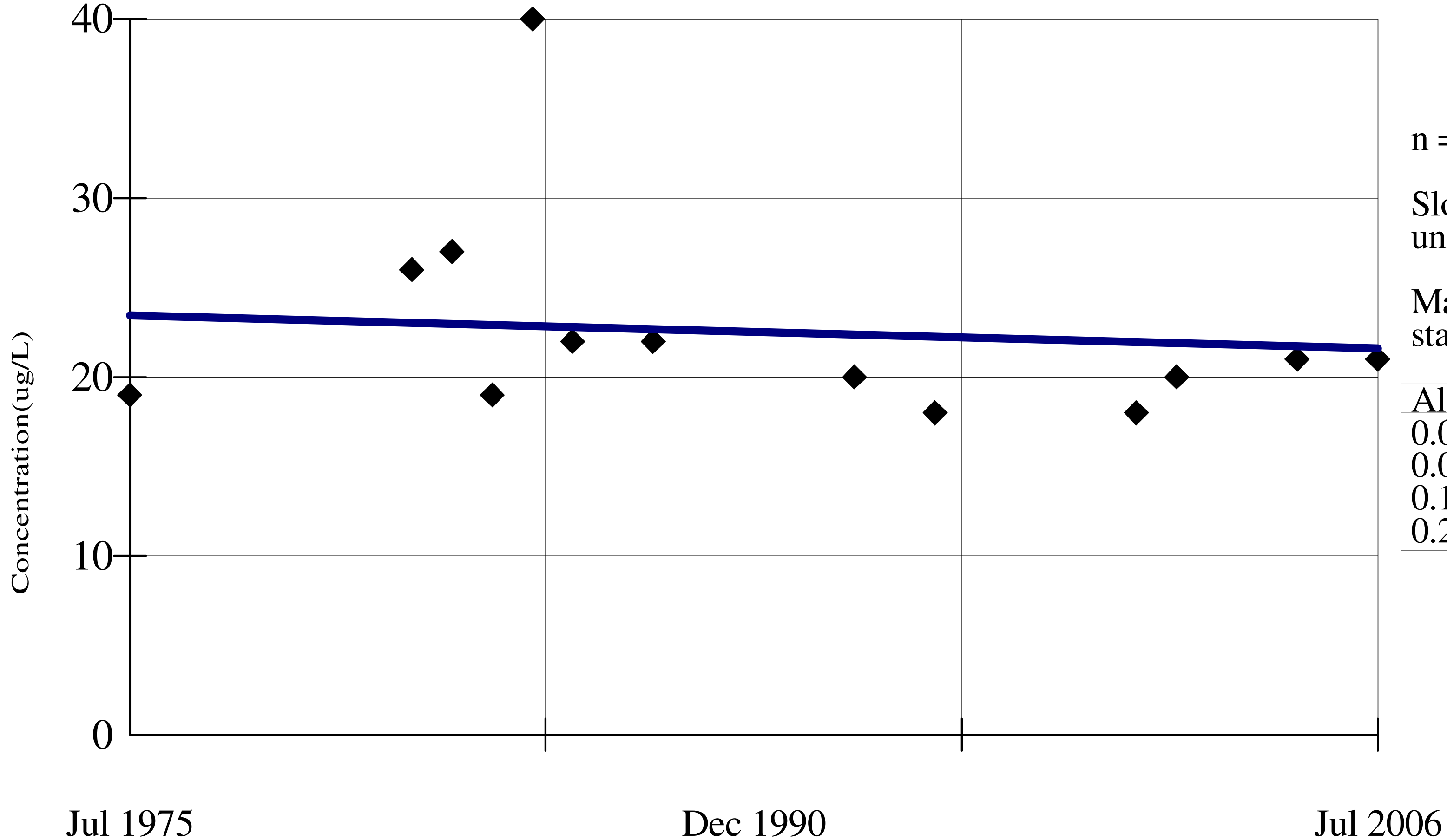
Webber, LR and Elrick, DE 1967 The soil and lake eutrophication. Proc. 10th Confr. on Great Lakes Res. pp 404-412.

Appendices

Appendix A

Lake Water Quality Trend Analyses

SEN'S SLOPE ESTIMATOR
Bush



n = 13

Slope = -0.059 units per year.

Mann Kendall statistic = -15

Alpha	Critical	Signif.
0.01	-43	No
0.05	-34	No
0.1	-29	No
0.2	-23	No

Constituent: TP (ug/L)

Facility: Lake Trend Analysis

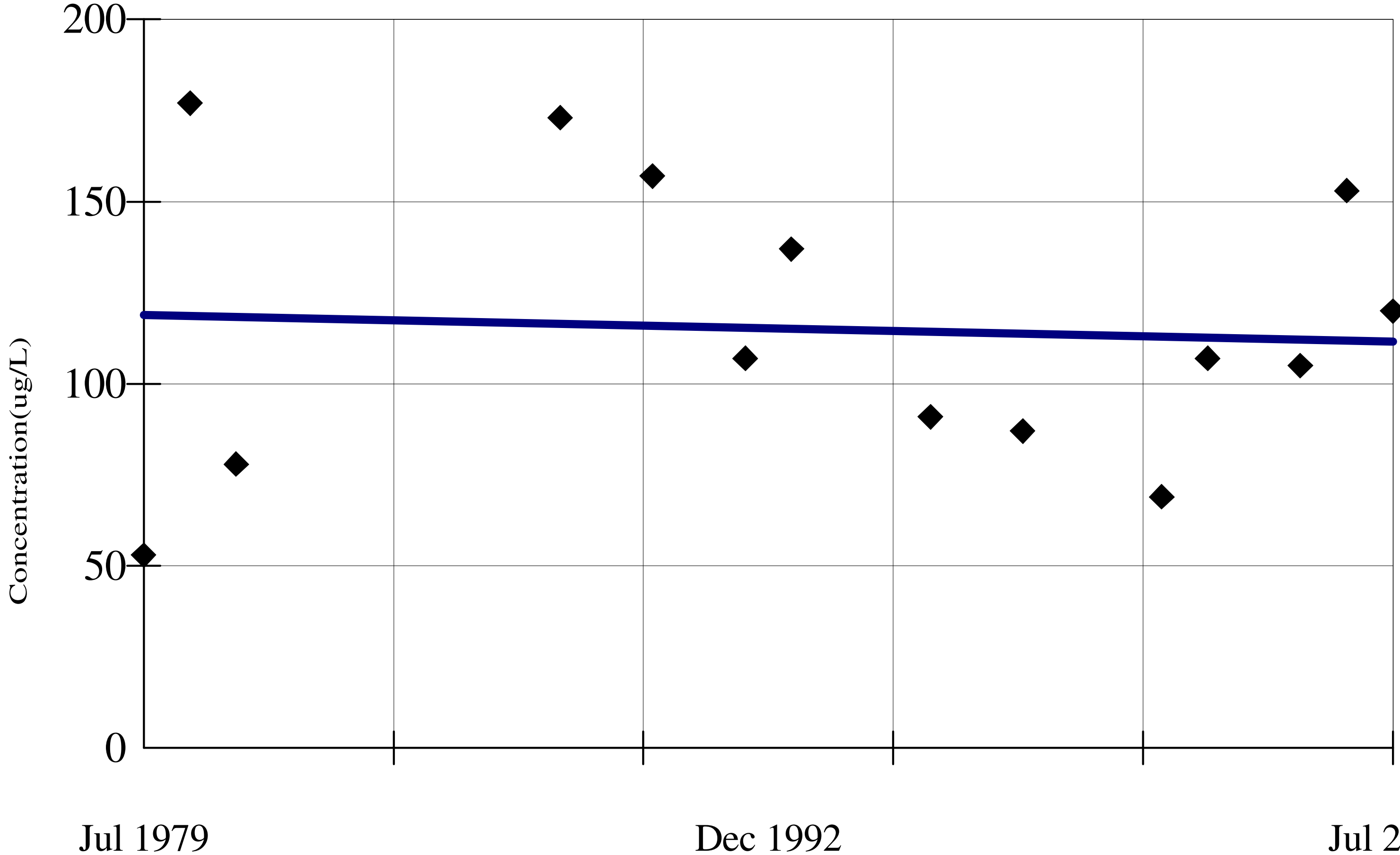
Data File: BUSH

Date: 7/2/07

Time: 11:05 AM

View: Bush_Trend

SEN'S SLOPE ESTIMATOR
Hyland



n = 14

Slope = -0.266
units per year.

Mann Kendall
statistic = -4

Alpha	Critical	Signif.
0.01	-48	No
0.05	-37	No
0.1	-32	No
0.2	-25	No

Constituent: TP (ug/L)

Date: 7/2/07

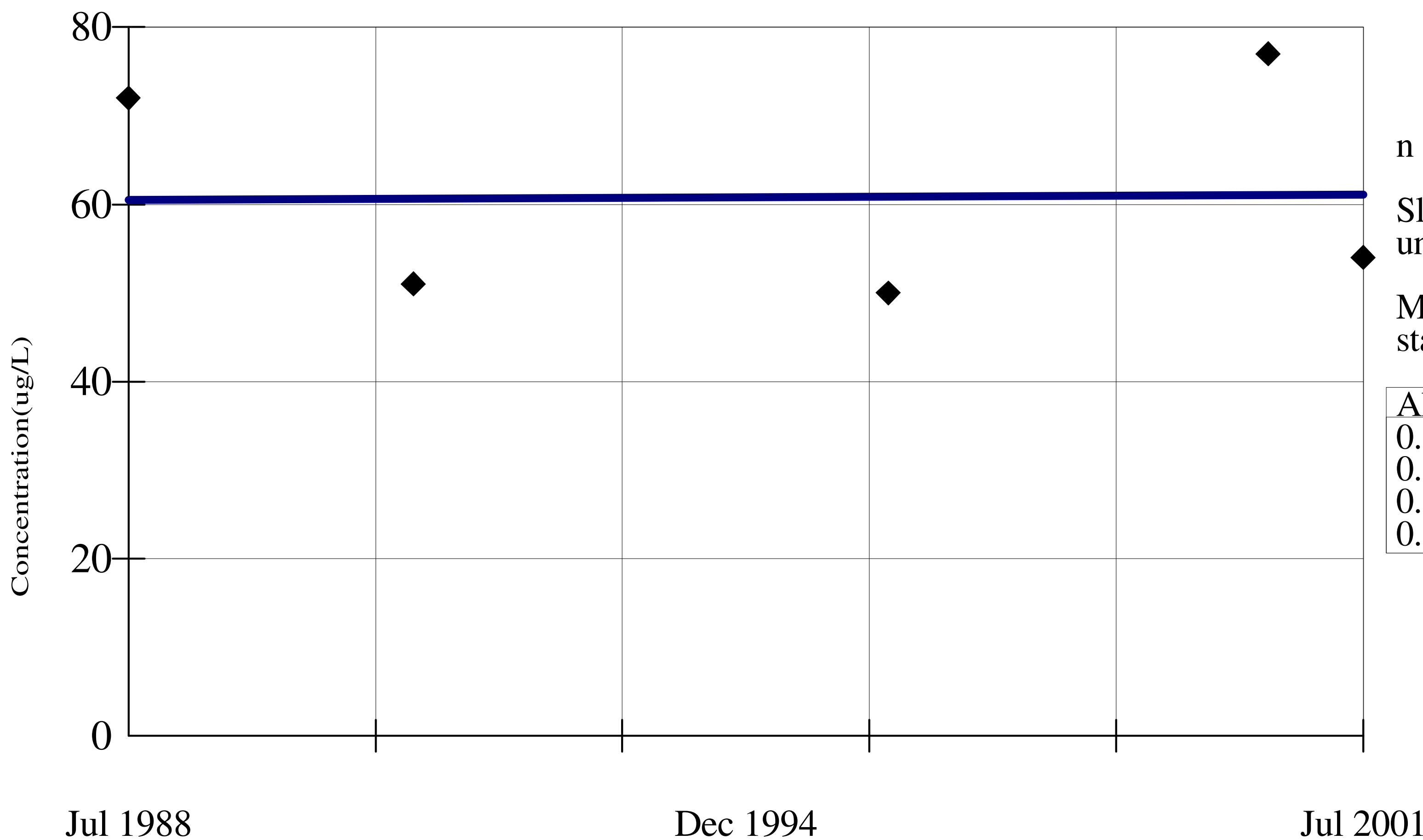
Facility: Lake Trend Analysis

Time: 11:07 AM

Data File: HYLAND

View: Hyland_Trend

SEN'S SLOPE ESTIMATOR
SEAndrs



n = 5

Slope = 0.05
units per year.

Mann Kendall
statistic = 0

Alpha	Critical	Signif.
0.01	12	No
0.05	10	No
0.1	8	No
0.2	7	No

Constituent: TP (ug/L) Facility: Lake Trend Analysis Data File: SEANDRSN

Date: 7/2/07 Time: 11:08 AM View: SEAnderson_Trend